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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/535,501	05/18/2005	Lian-Ming Sun	Serie 6022	4315

40582 7590 09/15/2010

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EXAMINER	
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ART UNIT	PAPER NUMBER
1793	

MAIL DATE	DELIVERY MODE
09/15/2010	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/535,501
Filing Date: May 18, 2005
Appellant(s): SUN ET AL.

Elwood Haynes
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 05-27-10 appealing the Office action mailed 02-04-10.

Real Party in Interest
Examiner has no comment on the statement of the real party in interest

Related Appeals and Interferences
No other appeals or interferences will directly affect or will be direct affected by or have a bearing on the Board's decision in the pending appeal.

Status of Claims
Claims 27 and 29-45 are rejected and the rejection of these claims has been appealed.

Status of Amendments
No amendments have been filed subsequent to the final office action of February 4, 2010.

Summary of Claimed Subject Matter
Examiner has no comment on the summary of claimed subject matter.

Grounds of Rejection to be Reviewed on Appeal
Applicant has only presented arguments against the use of Nataraj to reject claims 27 and 29-45. Applicant did not address the 103 rejection of Nataraj in view of Jinnouchi over claims 27 and 29-45 sent on 02-04-10.

Claims Index
Examiner has no comment on the copy of claims in the Appendix of the appeal.

Evidence Relied Upon
Nataraj (US 6,048,472)
Jinnouchi (GB 2123027 A)
Prasad (US 6,695,984)
Steynberg (US 2004/0245086)

Grounds of Rejection

Claims 27 and 29-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nataraj (US 6,048,472) in view of Jinnouchi (GB 2123027 A). Nataraj '472 teaches a two-step method of producing synthesis gas where a hydrocarbon mixture is first pre-

reformed and then reformed in a catalytic ceramic membrane after the first product is combined with an oxygen-containing gas (abstract, col. 6, steps (a)-(f). The synthesis gas produced comprises at least hydrogen, carbon containing compounds, water, and an oxygen-depleted mixture (Fig. 4, col. 6, steps (g) –(h). The present claims disclose the heating of an oxidizing mixture to a temperature of about 1000 degrees C prior to reforming. Nataraj does not teach this temperature but broadly teaches heating an oxygen-containing oxidant gas and introducing the heated gas feed into a mixed conducting membrane reactor and teaches that the mixed conducting membranes may require temperatures substantially above 649 degrees C (columns 6 and 8). The mixed conducting membrane reactor may be a ceramic membrane reactor (col. 3, lines 16-44) where a catalyst can be used (col. 3, lines 9-15). Jinnouchi teaches that the raw gases in a steam reforming reaction can be brought up to reaction temperatures which are between 750 and 1000 degrees C (p. 6, lines 9-15). Jinnouchi teaches bringing these "diluent gases" up to the temperature of the reaction. It would have been obvious to one of ordinary skill in the art at the time of the invention to have heated the oxidant gas in the method of Nataraj at a temperature such as 1000 degrees C because Jinnouchi teaches that gases for steam reforming can be heated to 1000 degrees C and that this process is energy efficient (pg. 2, line 46-pg. 3, line 7). Because Nataraj teaches that teaches that the mixed conducting membranes may require temperatures substantially above 649 degrees C, it would have been obvious to one of ordinary skill in the art that temperature at which the oxidant gas can be heated can be 1000 degrees

C for feeding to the mixed conducting membrane reactor for reaction at temperatures substantially above 649 degrees C.

Regarding Claim 29, Nataraj teaches in column 12, line 54 that the heated oxidant is at a temperature preferably within 200° F (111°C) of the partially reformed gas.

Regarding Claim 30, Nataraj teaches (col. 11, line 3) that desulphurization of a hydrocarbon mixture prior to reformation is well known in the steam reformation art.

Regarding Claims 31 and 33, Nataraj teaches desulfurization of a reactant gas at 260° C to 427° C (col. 10, line 65) which overlaps with the instant range. *In re Malagari*, 182 USPQ 549 (1974), found that a claimed invention is prima facie obvious over prior art if the applicant's claimed range touches a preferred range and the applicant has not rebutted the prima facie finding with a showing of unexpected properties in the range or a teaching away of the claimed range.

Regarding Claim 32, Nataraj teaches (col.10, line 65) the hydrogenation of a reactant gas prior to the desulfurization step. Column 11, lines 2-5 states that a hydrogenation step is well known in the steam reforming art.

Regarding Claims 34 and 36, Nataraj teaches (col. 11, line 32) that pre-reformation can occur in a catalytic reactor at a temperature between 372° C to 550° C. This range completely encompasses the applicant's claim.

Regarding Claim 35, Nataraj teaches (col. 7, line 3) the use of an adiabatic reactor in a pre-reformation step.

Regarding Claims 37-38, Nataraj teaches in column 15, lines 37-67 that the oxygen-depleted nonpermeate is at a temperature at or slightly below that of the raw

synthesis gas product. The temperature of the oxygen-depleted gas can be within 5° to 100° C of the synthesis gas. Nataraj also teaches (col. 14, line 50) that the reactant gas - the oxygen-containing gas—is preferably heated to the preferred temperature range of 816°, which is the same temperature as the raw synthesis gas when it is withdrawn from the outlet of the membrane reactor (col. 15, line 49). The claim states that the temperature difference is at least 75° C, which is encompassed in the disclosed range in Nataraj.

Regarding Claims 39 and 40, Nataraj teaches (col. 12, line 8) that the temperature range of the intermediate gas is 594° C to 760° C. *In re Malagari,* 182 USPQ 549 (1974), found that a claimed invention is prima facie obvious over prior art if the applicant's claimed range touches a preferred range and the applicant has not rebutted the prima facie finding with a showing of unexpected properties in the range or a teaching away of the claimed range.

Regarding Claim 42, Nataraj teaches (col. 16, line 59) that raw synthesis gas can be cooled and carbon dioxide can be removed from the synthesis gas.

Regarding Claims 43 and 44, Nataraj teaches a purification or treatment of the synthesis gas (col. 17, lines 12-18).

Regarding Claim 45, Nataraj teaches (col. 18, lines 55-60) the use of treated oxygen containing gas and the use of this gas in direct combustion (col. 19, line 36). Nataraj discloses the use of air as an oxygenated gas. Air is typically 15-21% by volume O_2. It would be obvious to one of ordinary skill in the art to increase the percentage molarity of oxygen in the oxygenated gas mixture the reaction for the combustion of

methane requires 2 moles of oxygen for every 1 mol of methane. Therefore, a greater volume of oxygen will make the reformation step more effective.

Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nataraj in view Jinnouchi as applied to claim 27, further in view of of Prasad (US 6,695,984). Nataraj states in column 15, line 57 that the temperature of the oxygen-depleted non-permeate is either at or slightly below that of raw synthesis gas. However, Nataraj does not teach the claimed temperature range of 800° C to 1100° C. Prasad refers in line 8 of claim 12 to a synthesis gas stream at a temperature between 950° and 1100° C. *In re Malagari*, 182 USPQ 549 (1974), found that a claimed invention is prima facie obvious over prior art if the applicant's claimed range touches a preferred range and the applicant has not rebutted the prima facie finding with a showing of unexpected properties in the range or a teaching away of the claimed range. It would have been obvious to one of ordinary skill in the art of synthesis gas production to combine these references as Nataraj teaches that the preferred temperature range is greater than 816° C (col. 18, lines 7 and 16). Further, Prasad teaches (col. 6, line 51) that temperatures of 1000° C to 1100° C in a reactor facilitate a nearly complete conversion of methane. Claims 27 and 29-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nataraj (US 6,048,472) in view of Steynberg (US 2004/0245086). Nataraj '472 teaches a two-step method of producing synthesis gas where a hydrocarbon mixture is first pre-reformed and then reformed in a catalytic ceramic membrane after the first product is combined with an oxygen-containing gas. The synthesis gas produced comprises at least hydrogen, carbon containing compounds, water, and an oxygen-depleted mixture.

The present claims disclose the heating of an oxidizing mixture to a temperature around 1000 degrees C prior to reforming. Nataraj does not teach this temperature range but teaches heating to 871 degrees C. Steynberg teaches the heating of the synthesis gas to between 1000 and 1200 degrees C. It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teachings of Steynberg with the teachings of Nataraj because Steynberg teaches the use of the waste heat for electrical energy in the process (0012-0013).

Regarding Claim 29, Nataraj teaches in column 12, line 54 that the heated oxidant is at a temperature preferably within 200° F (111°C) of the partially reformed gas.

Regarding Claim 30, Nataraj teaches (col. 11, line 3) that desulphurization of a hydrocarbon mixture prior to reformation is well known in the steam reformation art.

Regarding Claims 31 and 33, Nataraj teaches desulfurization of a reactant gas at 260° C to 427° C (col. 10, line 65) which overlaps with the instant range. *In re Malagari*, 182 USPQ 549 (1974), found that a claimed invention is prima facie obvious over prior art if the applicant's claimed range touches a preferred range and the applicant has not rebutted the prima facie finding with a showing of unexpected properties in the range or a teaching away of the claimed range.

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Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nataraj in view of Steynberg as applied to claim 27, further in view of Prasad (US 6,695,984). Nataraj states in column 15, line 57 that the temperature of the oxygen-depleted non-permeate is either at or slightly below that of raw synthesis gas. However, Nataraj does not teach the claimed temperature range of 800° C to 1100° C. Prasad refers in line 8 of claim 12 to a synthesis gas stream at a temperature between 950° and 1100° C. *In re Malagari*, 182 USPQ 549 (1974), found that a claimed invention is prima facie obvious over prior art if the applicant's claimed range touches a preferred range and the applicant has not rebutted the prima facie finding with a showing of unexpected properties in the range or a teaching away of the claimed range. It would have been obvious to one of ordinary skill in the art of synthesis gas production to combine these references as Nataraj teaches that the preferred temperature range is greater than 816° C (col. 18, lines 7 and

16). Further, Prasad teaches (col. 6, line 51) that temperatures of 1000° C to 1100° C in a reactor facilitate a nearly complete conversion of methane.

Response to Arguments

Applicant argues that the clause "about 1000 degrees Celsius" in claim 27 cannot be read to include the range taught in Nataraj. However, applicant's specification taught that temperature of the oxidizing mixture can be between 871 and 1100 degrees Celsius. This range helps to clarify the word "about" because applicant states that the reformation temperature can be 871 degrees Celsius. Examiner has not argued instrument error as applicant has stated but only that it would have been obvious to one of ordinary skill in the art at the time of the invention to increase the temperature in the prior art and that the prior art does not teach away from this possibility. Further, applicant's claim gives room for temperature fluctuation with the use of the word "about."

Applicant argues that Nataraj teaches a maximum temperature of 760 degrees C and that, therefore, the present claims are patentable over Nataraj. The most recent rejection of the present claims, however, is a 103 rejection over claims 27 and 29-45 over Nataraj in view of Jinnouchi and not Nataraj alone as applicant has argued. However, in response to applicant's current argument, Nataraj does not teach a maximum temperature in column 12, lines 53-60 but instead states a preferred embodiment of the invention where the oxidant can be within 200 degrees Fahrenheit of the gas temperature at the inlet where the gas temperature is between 594 to 760 degrees Celsius. One of ordinary skill in the art at the time of the invention would know

that the temperature can be outside of a preferred range and may be higher than the preferred temperature. Nataraj does not provide an upper limit as applicant states. For example, Nataraj further teaches that heated oxygen-containing gas is introduced into the reactor at above 594 degrees Celsius (column 19, lines 35-39). Thus the reference does not place any upper limit on the temperature at which the oxidant can be introduced, and the range of 594 to 760 degrees Celsius is merely preferred. The word "preferably" indicates that this temperature is not a maximum but only the desired temperature. Because the temperature is merely a preferred embodiment, one of ordinary skill in the art at the time of the invention would find applicant's claimed "about 1000 degrees C" to be obvious in such a reactor.

Applicant argues that the broad range of the application was narrowed in order to circumvent any cited art. This argument does not address the fact that the range claimed is still obvious. Despite the fact that Nataraj alone does not teach the temperature range, the claimed range is still obvious under the rejection. Further, applicant has acknowledged that a reactor may operate using a broad temperature range because the claim was narrowed from a broader range discussed in the specification.

Applicant states that examiner has implied instrument error on the part of a technician or plant operator. No such implication was made. Examiner has merely stated that applicant has claimed an obvious temperature range in the present claims.

Finally, applicant argues that when the prior art should not be interpreted so that the oxidant can be within 200 degrees Fahrenheit of the intermediate gas but that both

the oxidant and the intermediate gas must be in the range taught (reference to col. 1, lines 53-60; applicant's appeal brief page 15). However, the prior art states that the oxidant is within a temperature range of the gas and states the gas's temperature. The prior art cannot be interpreted so that the word "gas" encompasses both the gas which is referred to in the paragraph and the oxidant which is distinguished from the gas. Applicant's suggested interpretation that the word gas now refers to another reactant is not reasonable. Additionally, the oxidant can be 200 degrees hotter or cooler than the gas as stated in the cited section. Applicant has not explained why one skilled in the art would recognize that this statement should only be interpreted where the oxidant is 200 degrees less.

Related Proceedings Appendix
There are no related proceedings.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Melissa Stalder/

September 8, 2010

/Melvin Curtis Mayes/

Supervisory Patent Examiner, Art Unit 1793

Conferees:

/Melvin Curtis Mayes/

Supervisory Patent Examiner, Art Unit 1793

/Anthony McFarlane/